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POST OPERATIVE PAIN AND HAZE IN TRANSEPITHELIAL VS ALCOHOL ASSISTED PHOTOREFRACTIVE KERATECTOMY

Ophthalmology

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ABSTRACT

Photorefractive keratectomy (PRK) is a corneal refractive surgical technique using excimer laser. In transepitelial PRK (tPRK) ,relatively newer procedure of laser refractive correction, the epithelium and stroma are removed in a single step.

METHODS : A prospective study was conducted in 372 eyes consisting of 186 patients were studied in a tertiary eye care hospital. Out of which 180 eyes underwent aaPRK and 192 eyes underwent tPRK.Post operative healing was evaluated in all the patients in terms of pain ,epithelial healing and corneal haze.

RESULTS : Pain was significantly lower in tPRK group compared to aaPRK on day 1 postoperatively.Epithelial healing was early in tPRK (86.97%) in 6 days compared to aaPRK group (23.32%). Corneal haze was less than grade 1 postoperatively at 1month in tPRK group (95.3%) compared to aaPRK group (89.64%)

CONCLUSIONS : Early postoperative epithelial healing is observed which inturn causes less pain and crneal haze in transepithelial PRK group compared to alcohol assisted PRK group

KEYWORDS

photorefractive keratectomy, postoperative pain, corneal haze ,epithelial Healing.

Introduction

Photorefractive keratectomy (PRK) is a corneal refractive surgical technique using excimer laser,was introduced more than 25 years ago.[1,2]This surgery which was used as a mainstream refractive modality was declined during the late 1990s and early twenty-first century due to the dramatic increase in laser in-situ keratomileusis (LASIK). However, there has been a resurgence of interest in the PRK procedure correction when proper patient selection,surgical technique, and quality postoperative care occur.[3-7]

Before the excimer laser ablation the epithelium was removed by manual mechanical scraping ,later it was enhanced by using alcohol solution. [8] Earlier the main disadvantage of PRK are postoperative pain, delayed epithelial healing, and postoperative corneal haze. An alternative for this is the transepithelial PRK where the epithelium is removed by phototherapeutic ablation (PTK) ,followed by a stromal laser refractive ablation[9-12]. Advantages of transepithelial PRK are noncontact echnique, reduce intervention time and minimizes the size of epithelial defect required for stromal ablation , avoidance of alcohol thereby reducing toxicity.

tPRk targets 55µm and 65µm peripherally ,for an 8mm ablation zone with further consideration to differential ablation rate in epithelium compared to stroma . The ablation is carried out as a single continous profile .

Mitomycin C[MMC] is used as adjunctive for reducing the post operative stromal haze [13]

The main aim of the study was to assess postoperative pain , epithelial healing and corneal haze and compare the aaPRK group with tPRK group.

METHODS

This is a prospective study carried out in a tertiary eye care hospital in Hyderabad, telangana state in the patients who underwent aaPRK and transepithelial PRK (tPRK) between September 2016 to September 2017 for a period of one year .

- A total of 372 eyes consisting of 186 patients were studied. Out of which 180 eyes underwent aaPRK and 192 eyes underwent tPRK. The study population have the following inclusion criteria: age more than 21 years,a stable refractive error for atleast 12 months before the surgery,simple myopia or myopic astigmatism, refractive error withi the range of -1.0 to -8.0D, contact lens discontinuation for atleast 2 weeks.

Exclusion criteria are ocular conditions like high myopia >8D, lid abnormalities, dry eyes, clinical and subclinical cases of keratoconus, previous cases of cataract and glaucoma, cases with abnormal corneal topography, and systemic conditions like diabetes, connective tissue disorders and pregnancy.

Preoperative Assessment :

All the patients were evaluated as follows .Prior ocular and general medical history,contact lens wear, topical and systemic medication use were noted.Thorough assessment of refraction including subjective correction by two persons .Complete ocular examination of anterior and posterior segments were done by Slit lamp biomicroscoy,direct and indirect ophthalmoscopy, tonometry.Sirius examination includes pupillometry, placido disc, rotating scheimpflug camera and ocular aberrometry.

Data was entered in Microsoft excel and analysis was done using SPSS version 20.

Descriptive statistical analysis was done . Results on categorical measurements are presented as Percentages. Chi square test was used to find out the significance of study parameters on a categorical scale between two groups .Significance is assessed at 5 % level of significance. P<0.05– statistically significant. P<0.001- statistically highly significant.

Procedure :

The surgeries were performed with 750 S version,Amaris excimer laser.

Proparacaine hydrochloride 0.5% drops were instilled before the surgery .20% ethyl alcohol was placed on the cornea in aaPRK group within an 8.5mm cone and left in place for 30 seconds. Then the excess of alcohol is absorbed using merocel sponge .

The epithelium was removed using blunt spatula followed by stromal ablation using excimer laser In tPRK group, the epithelium was removed during laser ablation from the total ablation zone. In both the groups 0.02% of mitomycin C was applied for 10 sec per diopter power of myopia followed by irrigation with balanced salt solution .Bandage contact lens was applied after the surgery for 5 days.All the patients were given topical antibiotic eye drops (four times a day), topical fluorometholone eye drops (six times per day), lubricant eye drops(six times a day). Post operative examinations were done at day 1, day 5, 1st month ,5th month included evaluation of pain by 10-category verbal rating scale (1- no pain and 10-worst possible pain),visual acuity, slit lamp examination, tonometry.

Corneal haze was evaluated as proposed by Fantes at al [14](0=no haze,0.5=trace haze on;1=corneal cloudiness not interfering with

visibility of iris details; 2= mild effacement of iris details; 3 and 4=iris and lens details not discernible)

RESULTS :

A total of 372 eye were studied , of which 180 eyes underwent aaPRK and 192eyes underwent tPRK.

Table:1 Age distribution:

Age in years	aaPRK (n=180)	tPRK(n=192)
21-30	138	155
31-40	35	31
41-50	7	6

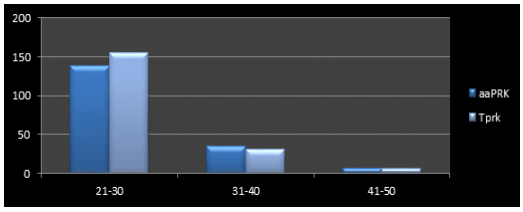

Figure -1 Age distribution:

Table :2 Sex distribution:

	aaPRK(n=180)	Percentage	tPRK (n=192)	Percentage
Females	98	54.44%	112	58.33%
Males	82	45.55%	80	41.66%

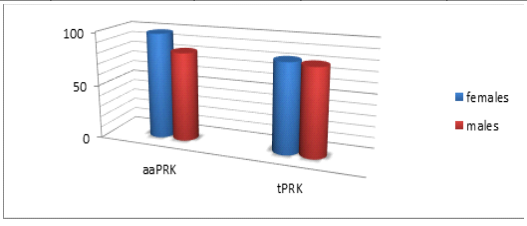

Figure 2: Sex distribution

Table :3 Distribution according to refractive error

Amount of error in diopters	aaPRK (n=180)	Percentage	tPRK(n=192)	Percentage
1—2	68	37.77%	83	43.22%
2.25 – 4	83	46.11%	81	42.18%
4.25 – 6	16	8.89%	19	9.89%
6.25 – 8	13	7.22%	09	4.68%

Table :4 Pain scale : on Day 1

Scale	aaPRK (n=180)	Percentage	tPRK (n=192)	Percentage
0-1	12	6.73%	68	35.41%
2-6	142	78.89%	116	60.41%
7-10	26	14.44%	08	4.16%

Chi-square (x^2) = 51.016 df = 2 p < 0.001 *s (statistically highly significant)

On post op day 1, pain was significantly less in tPRK group than that of aaPRK group (P<0.001*HS). Transepithelial PRK technique, demonstrates significantly reduced postoperative pain, compared with alcohol-assisted PRK.

Table :5 Epithelial defect healing :

In days	aaPRK(n=180)	Percentage	tPRK (n=192)	Percentage
1-3	5	2.77%	16	8.33%
4-6	37	20.55%	151	78.64%
7-9	90	50.00%	15	7.81%
10-12	44	24.44%	08	4.16%
>12	04	2.22%	02	1.04%

Chi-square (x^2) = 153.824 df = 4 p < 0.001* (statistically highly significant)

Epithelial healing was significantly faster tPRK group than that of aaPRK group (P < 0.001*) Highly significant . Transepithelial PRK technique, demonstrates significantly faster epithelial healing compared with alcohol-assisted PRK.

Table 6 : Corneal haze grade at 1 month post op

Grade	aaPRK (n=180)	Percentage	tPRK(n=192)	Percentage
0	136	76.31%	175	91.14%
0.5	24	13.33%	08	4.16%
1	08	4.44%	06	3.12%
2	11	6.11%	02	1.04%
3	01	0.55%	01	0.52%
4	00	0.00%	00	0.00%

Chi-square (x^2) = 19.04 df = 5 p < 0.001* (statistically highly significant)

Corneal haze was significantly less in Tprk group than that of aaPRK group (p < 0.001* highly significant). Transepithelial PRK technique demonstrates significantly less postoperative corneal haze compared with alcohol-assisted PRK.

DISCUSSION

The present study was done to compare the postoperative healing in terms of postoperative pain, epithelial healing and corneal haze in patients who have undergone alcohol assisted PRK and compare with the patients who underwent transepithelial PRK . The main limitations of conventional PRK technique were postoperative pain, photophobia, corneal haze and delayed visual recovery[11,13,15,16,17]

In the present study the postoperative epithelial healing was early in transepithelial PRK group compared to aaPRK group.A similar study comparing the all surface ablation (ASLA) to aaPRK showed the future role of ASLA in refractive surgery, because of faster epithelial healing ,lower pain scores, and significantly less haze formation . [18]

In this study ,the factors such as age and sex are not associated with the postoperative healing .Similar studies have been reported where age and amount of ablation were not associated with pain and discomfort after advanced surface ablation(ASA) .[19]

Advanced surface ablation (ASA) produces a direct injury of the nerves of the treated corneal area , including epithelium and upper stromal layers,[20,21]and pain is associated with the corneal healing process.[22] The primary finding of this study was tPRK offers significantly reduced early postoperative pain at day 1 and day 5 compared to aaPRK. Aslanides et al[18] and Fadlallah et al [23]reported decreased postoperative pain after single step tPRK, which was confirmed by our results The recommended methods for assessment of pain intensity are numerical rating scale (NRS), verbal rating scale (VRS) or visual analogue scale (VAS)[24] .NRS and VRS are validated scales ,showed high concordance between them and are sensitive in assessing acute pain after surgery[25]. These three scales were assessed for post operative pain in a study[24]. The choice is not the type of scale but the condition related to its use such as standardized choice of descriptor , methods of administration and time frame[24]. The validity of VAS and NRS could be extended by using clinically relevant descriptors of pain such as proportion of patients reporting need for analgesia[26].Some recent studies have reviewed pain management strategies after PRK[27-30]. These strategies include the use of BSS during the procedure and the use of entended wear bandage contact lens until re epithelialization occurs[30].Topical NSAIDS are used for the management of post operative pain and discomfort following refractive surgeries [27].Oral analgesics such as NSAIDS and opiates are used for post operative pain[31].

In our study 86.97% of tPRK group achieved epithelial healing by 6th day post operatively whereas only 23.32% of aaPRK achieved epithelial healing in 6days post op which shows there is faster epithelial healing in tPRK group. In tPRK the refractive ablation is applied over the epithelium ,which removes the epithelium completely or incompletely and the subsequent ablation profile advances the curvature down to stroma .This reverse sequence maximizes the smoothing effect of epithelium over stromal irregularities and utilizes the early period of expected better cooperation and fixation for the critical refractive ablation , leaving the less alignment –critical profile for the end. Keratocyte apoptosis and myofibroblast activation is a key factor in stromal recovery after surface ablation procedures and transepithelial ablation results in lower levels of keratocyte apoptosis [32,33]. Epithelial regeneration and integrity is paramount to initiate cytokine induction , which in turn activates stromal wound healing [34]. Alcohol delamination of corneal epithelium can provide a smooth surface at the level of Bowmans membrane ,the viability of epithelial

cells is reduced with potential limbal effects[34,35]. Agarwal et.al observed an inflammatory response and damage to the anterior stromal keratocytes , after alcohol exposure ,which could potentiate corneal haze formation High resolution spectral OCT failed to detect differences in corneal healing process after tPRK and aaPRk , except for shorter time to cover the stroma with epithelium in tPRK group[36].

The main limitation of alcohol assisted PRK is post operative haze[13,37,38]. In our study 91.14% of the patients who underwent trans epithelial PRK had no corneal haze whereas only 76.31% of the patients of aaPRK group had no corneal haze at 1month . Haze is a side effect of PRK associated with high ablations discontinuation of steroids,post operative UV exposure and male sex[37,38].The use of Mitomycin C(MMC) adjunctive therapy has resulted in less post operative and has played a major role in the to the current resurgence of PRK .The limitation of the present study is the corneal haze difference in sex proportions between the two groups was not studied.There are statistically more females in tPRK group ,which may be a source of bias especially in pain evaluation. [39]

Single step tPRK technique takes considerably less time than aaPRK ,also it helps in preventing dehydration prior to ablation .

CONCLUSION:

No touch Single step Transepithelial PRK technique demonstrates less post operative pain, significantly faster epithelial healing and reduced corneal haze compared with alcohol assisted PRK.

REFERENCES

1. Marshall J. Photoablative reprofiling of the cornea using an excimer laser: photorefractive keratectomy. Lasers Ophthalmol. 1986;1:21-48.
2. Trokel SL, Srinivasan R, Braren B. Excimer laser surgery of the cornea. American journal of ophthalmology. 1983 Dec 1;96(6):710-5.
3. Puliafito CA, Steinert RF, Deutsch TF, Hillenkamp F, Dehm EJ, Adler CM. Excimer laser ablation of the cornea and lens: experimental studies. Ophthalmology. 1985 Jun 1;92(6):741-8.
4. Gartry DS, Muir MG, Marshall J. Excimer laser photorefractive keratectomy: 18-month follow-up. Ophthalmology. 1992 Aug 1;99(8):1209-19.
5. Sher NA, Chen V, Bowers RA, Frantz JM, Brown DC, Eiferman R, Lane SS, Parker P, Ostrov C, Doughman D, Carpel E. The use of the 193-nm excimer laser for myopic photorefractive keratectomy in sighted eyes: a multicenter study. Archives of Ophthalmology. 1991 Nov 1;109(11):1525-30.
6. Sher NA, Hardten DR, Fundingsland B, DeMarchi J, Carpel E, Doughman DJ, Lane SS, Ostrov C, Eiferman R, Frantz JM, Robin J. 193-nm excimer photorefractive keratectomy in high myopia. Ophthalmology. 1994 Sep 1;101(9):1575-82.
7. Talley AR, Hardten DR, Sher NA, Kim MS, Doughman DJ, Carpel E, Ostrov CS, Lane SS, Parker P, Lindstrom RL. Results one year after using the 193-nm excimer laser for photorefractive keratectomy in mild to moderate myopia. American journal of ophthalmology. 1994 Sep 1;118(3):304-11.
8. Abad JC, An B, Power WJ, Foster CS, Azar DT, Talamo JH. A prospective evaluation of alcohol-assisted versus mechanical epithelial removal before photorefractive keratectomy. Ophthalmology. 1997 Oct 1;104(10):1566-75.
9. Pedrotti E, Sbabo A, Marchini G. Customized transepithelial photorefractive keratectomy for iatrogenic ametropia after penetrating or deep lamellar keratoplasty. Journal of Cataract & Refractive Surgery. 2006 Aug 1;32(8):1288-91.
10. Camellin M, Mosquera SA. Simultaneous aspheric wavefront-guided transepithelial photorefractive keratectomy and phototherapeutic keratectomy to correct aberrations and refractive errors after corneal surgery. Journal of Cataract & Refractive Surgery. 2010 Jul 1;36(7):1173-80.
11. La Tegola MG, Alessio G, Sborgia C. Topographic customized photorefractive keratectomy for regular and irregular astigmatism after penetrating keratoplasty using the LIGI CIPTA/LaserSight platform. Journal of refractive surgery. 2007 Sep 1;23(7):681-93.
12. Kanitkar KD, Camp J, Humble H, Shen DJ, Wang MX. Pain after epithelial removal by ethanol-assisted mechanical versus transepithelial excimer laser debridement. Journal of refractive surgery. 2000 Sep 1;16(5):519-22.
13. Carones F, Vigo L, Scandola E, Vacchini L. Evaluation of the prophylactic use of mitomycin-C to inhibit haze formation after photorefractive keratectomy. Journal of Cataract & Refractive Surgery. 2002 Dec 1;28(12):2088-95.
14. Fantes FE, Hanna KD, Waring GO, Pouliquen Y, Thompson KP, Savoldelli M. Wound healing after excimer laser keratomileusis (photorefractive keratectomy) in monkeys. Archives of Ophthalmology. 1990 May 1;108(5):665-75.
15. Ghoreishi M, Attarzadeh H, Tavakoli M, Moini HA, Zandi A, Masjedi A, Rismanchian A. Alcohol-assisted versus mechanical epithelium removal in photorefractive keratectomy. Journal of ophthalmic & vision research. 2010 Oct;5(4):223.
16. Caubet E. Cause of subepithelial corneal haze over 18 months after photorefractive keratectomy for myopia. Journal of Refractive Surgery. 1993 Mar 1;9(2):S65-70.
17. Kuo IC, Lee SM, Hwang DG. Late-onset corneal haze and myopic regression after photorefractive keratectomy (PRK). Cornea. 2004 May 1;23(4):350-5.
18. Aslanides IM, Padroni S, Mosquera SA, Ioannides A, Mukherjee A. Comparison of single-step reverse transepithelial all-surface laser ablation (ASLA) to alcohol-assisted photorefractive keratectomy. Clinical ophthalmology (Auckland, NZ). 2012;6:973.
19. Kymionis GD, Kankariya VP, Plaka AD, Reinstein DZ. Femtosecond laser technology in corneal refractive surgery: a review. Journal of Refractive Surgery. 2012 Dec 1;28(12):912-20.
20. Tervo K, Latvala TM, Tervo TM. Recovery of corneal innervation following photorefractive keratoablation. Archives of Ophthalmology. 1994 Nov 1;112(11):1466-70.
21. Erie JC, McLaren JW, Hodge DO, Bourne WM. Recovery of corneal subbasal nerve density after PRK and LASIK. American journal of ophthalmology. 2005 Dec 1;140(6):1059-64.
22. Sher NA, Frantz JM, Talley A, Parker P, Lane SS, Ostrov C, Carpel E, Doughman D, DeMarchi J, Lindstrom R. Topical diclofenac in the treatment of ocular pain after excimer photorefractive keratectomy. Journal of Refractive Surgery. 1993 Nov 1;9(6):425-36.
23. Fadlallah A, Fahed D, Khalil K, Dunia I, Menassa J, El Rami H, Chlela E, Fahed S. Transepithelial photorefractive keratectomy: clinical results. Journal of Cataract & Refractive Surgery. 2011 Oct 1;37(10):1852-7.
24. Hjermstad MJ, Fayers PM, Haugen DF, Caraceni A, Hanks GW, Loge JH, Fainsinger R, Aass N, Kaasa S, European Palliative Care Research Collaborative (EPCRC. Studies comparing Numerical Rating Scales, Verbal Rating Scales, and Visual Analogue Scales for assessment of pain intensity in adults: a systematic literature review. Journal of pain and symptom management. 2011 Jun 1;41(6):1073-93.
25. Sipos E, Stifter E, Menapace R. Patient satisfaction and postoperative pain with different postoperative therapy regimens after standardized cataract surgery: a randomized intraindividual comparison. International ophthalmology. 2011 Dec 1;31(6):453-60.
26. Gallagher EJ, Bijur PE, Latimer C, Silver W. Reliability and validity of a visual analog scale for acute abdominal pain in the ED. The American journal of emergency medicine. 2002 Jul 1;20(4):287-90.
27. Woreta FA, Gupta A, Hochstetler B, Bower KS. Management of post-photorefractive keratectomy pain. survey of ophthalmology. 2013 Nov 1;58(6):529-35.
28. Kim SJ, Flach AJ, Jampol LM. Nonsteroidal anti-inflammatory drugs in ophthalmology. Survey of ophthalmology. 2010 Mar 1;55(2):108-33.
29. Niizuma T, Ito S, Hayashi M, Futemma M, Utsumi T, Ohashi K. Cooling the cornea to prevent side effects of photorefractive keratectomy. Journal of Refractive Surgery. 1994 Mar 1;10(2):S262-6.
30. Engle AT, Laurent JM, Schallhorn SC, Toman SD, Newacheck JS, Tanzer DJ, Tidwell JL. Masked comparison of silicone hydrogel lotrafilcon A and etafilcon A extended-wear bandage contact lenses after photorefractive keratectomy. Journal of Cataract & Refractive Surgery. 2005 Apr 1;31(4):681-6.
31. Pakravan M, Roshani M, Yazdani S, Faramazi A, Yaseri M. Pregabalin and gabapentin for post-photorefractive keratectomy pain: a randomized controlled trial. European journal of ophthalmology. 2012 Apr;22(7_suppl):106-13.
32. Helena MC, Baerveldt F, Kim WJ, Wilson SE. Keratocyte apoptosis after corneal surgery. Investigative ophthalmology & visual science. 1998 Feb 1;39(2):276-83.
33. Kim WJ, Shah S, Wilson SE. Differences in keratocyte apoptosis following transepithelial and laser-scrape photorefractive keratectomy in rabbits. Journal of refractive surgery. 1998 Sep 1;14(5):526-33.
34. Chen CC, Chang JH, Lee JB, Javier J, Azar DT. Human corneal epithelial cell viability and morphology after dilute alcohol exposure. Investigative ophthalmology & visual science. 2002 Aug 1;43(8):2593-602.
35. Browning AC, Shah S, Dua HS, Maharajan SV, Gray T, Bragheeth MA. Alcohol debridement of the corneal epithelium in PRK and LASEK: an electron microscopic study. Investigative ophthalmology & visual science. 2003 Feb 1;44(2):510-3.
36. Kaluzny BJ, Szkulmowski M, Bukowska DM, Wojtkowski M. Spectral OCT with speckle contrast reduction for evaluation of the healing process after PRK and transepithelial PRK. Biomedical optics express. 2014 Apr 1;5(4):1089-98.
37. Caubet E. Cause of subepithelial corneal haze over 18 months after photorefractive keratectomy for myopia. Journal of Refractive Surgery. 1993 Mar 1;9(2):S65-70.
38. Kuo IC, Lee SM, Hwang DG. Late-onset corneal haze and myopic regression after photorefractive keratectomy (PRK). Cornea. 2004 May 1;23(4):350-5.
39. Omulecki W, Laudańska-Olszewska I, Synder A. Factors affecting patient cooperation and level of pain perception during phacoemulsification in topical and intracameral anesthesia. European journal of ophthalmology. 2009 Nov;19(6):977-83.